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WHC-EP-0342
Addendum 31

209-E Laboratory Reflector Water Stream-Specific Report

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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209-E Laboratory Reflector Water Stream-Specific Report

E. H. Neilsen

Date Published
August 1990

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209-E LABORATORY REFLECTOR WATER STREAM-SPECIFIC REPORT

E. H. Neilsen

ABSTRACT

The proposed wastestream designation for the 209-E Laboratory reflector water wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations.* *A combination of process knowledge and sampling data was used to make this determination.*

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*Ecology, 1989, *Dangerous Waste Regulations*, Washington (State) Administrative Code (WAC) 173-303, Washington State Department of Ecology, Olympia, Washington.

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EXECUTIVE SUMMARY

The proposed designation for the 209-E Laboratory reflector water is that this stream is not a dangerous waste pursuant to the Washington (State) Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*. A combination of process knowledge and present sampling data were used to determine if the effluent contains a listed dangerous waste (WAC 173-303-080). Sampling data alone is compared to the dangerous waste criteria (WAC 173-303-080) and dangerous waste characteristics (WAC 173-303-090). Sample data are based on samples downstream of all process contributors. Sample data consist of three samples taken at one sampling point from December 3, 1987, to December 18, 1987. The "listed" dangerous waste determination was made with process data supplemented with sampling data; the "criteria" and "characteristic" dangerous waste determinations were made with sampling data supplemented by process data. The 209-E Critical Mass Laboratory has been permanently shut down and no effluent is released from the facility. There are no plans to operate this facility in the future.

*Ecology, 1989, *Dangerous Waste Regulations*, Washington Administrative Code (WAC) 173-303, Washington State Department of Ecology, Olympia, Washington.

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LIST OF TERMS

ASTM	American Society for Testing and Materials
CML	Critical Mass Laboratory
CY	calendar year
DCG	derived concentration guidelines
DOE	U.S. Department of Energy
DWS	drinking water standards
Ecology	Washington State Department of Ecology
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
GE	General Electric Corporation
HH	halogenated hydrocarbons
MCL	maximum concentration level
MSDS	Material Safety Data Sheet
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
SP	specific positive (carcinogen)
TC	total carcinogen
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
WAC	Washington (State) Administrative Code
EC%	percent equivalent concentration
wt%	weight percent
90%CI	90% confidence interval

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209-E LABORATORY REFLECTOR WATER STREAM-SPECIFIC REPORT

1.0 INTRODUCTION

1.1 BACKGROUND

In response to the *Hanford Federal Facility Agreement* and *Consent Order* (Tri-Party Agreement) (Ecology et al. 1989), comments from the public were received regarding reduction of the discharge of liquid effluents into the soil column. As a result, the U.S. Department of Energy (DOE), with concurrence of the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA), committed to assess the contaminant migration potential of liquid discharges at the Hanford Site (Lawrence 1989).

This assessment is described in the *Liquid Effluent Study Project Plan* (WHC 1990b), a portion of which characterizes 33 liquid effluent streams. This characterization consists of integrating the following elements, pursuant to the Washington (State) Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*, (Ecology 1989): process data, sampling data, and dangerous waste regulations.

The results of the characterization study are documented in 33 separate reports, one report per wastestream. The complete list of stream-specific reports appears in Table 1-1. This document is one of the 33 reports.

1.2 APPROACH

This report characterizes the 209-E Laboratory reflector water in sufficient detail so that a wastestream designation, in accordance with WAC 173-303 can be proposed.

This characterization effort (shown in Figure 1-1) is implemented by means of the following steps.

1. Describe both process knowledge and sampling data (Sections 2.0 and 3.0).

2. Compare the data (Section 4.0).

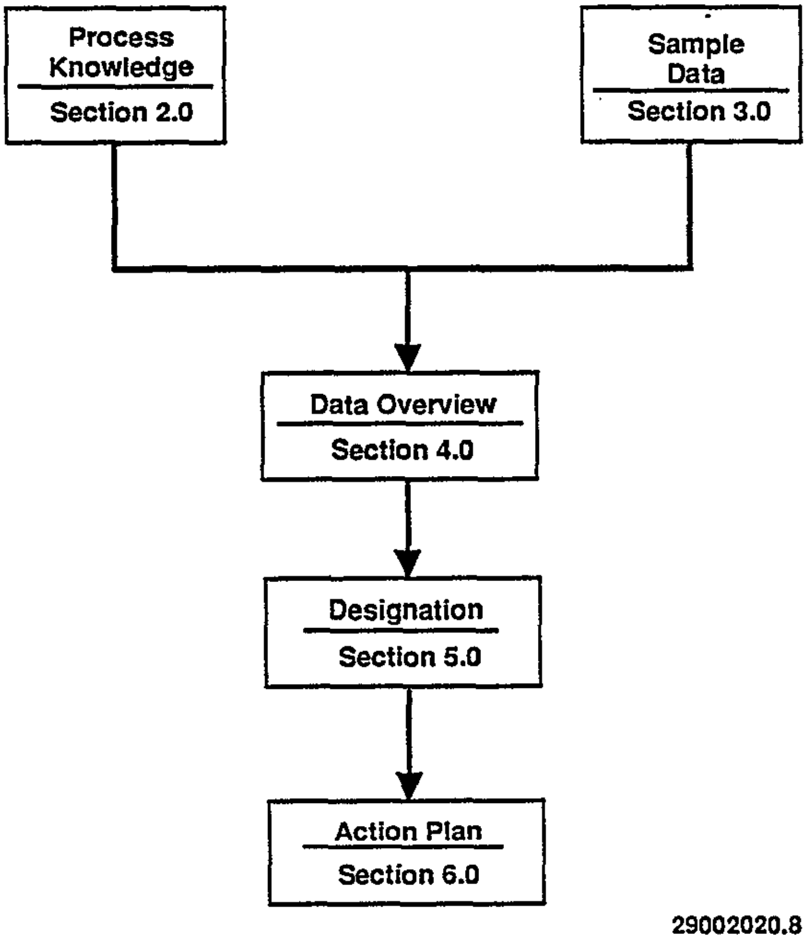
3. Propose a designation (Section 5.0).

4. Design an action plan, if needed, to obtain additional characterization data (Section 6.0).

Table 1-1. Stream-Specific Report Reference List.

WHC-EP-0342	Addendum 1	300 Area Process Wastewater
WHC-EP-0342	Addendum 2	PUREX Plant Chemical Sewer
WHC-EP-0342	Addendum 3	N Reactor Effluent
WHC-EP-0342	Addendum 4	163N Demineralization Plant Wastewater
WHC-EP-0342	Addendum 5	PUREX Plant Steam Condensate
WHC-EP-0342	Addendum 6	B Plant Chemical Sewer
WHC-EP-0342	Addendum 7	UO_3/U Plant Wastewater
WHC-EP-0342	Addendum 8	Plutonium Finishing Plant Wastewater
WHC-EP-0342	Addendum 9	S Plant Wastewater
WHC-EP-0342	Addendum 10	T Plant Wastewater
WHC-EP-0342	Addendum 11	2724-W Laundry Wastewater
WHC-EP-0342	Addendum 12	PUREX Plant Process Condensate
WHC-EP-0342	Addendum 13	222-S Laboratory Wastewater
WHC-EP-0342	Addendum 14	PUREX Plant Ammonia Scrubber Condensate
WHC-EP-0342	Addendum 15	242-A Evaporator Process Condensate
WHC-EP-0342	Addendum 16	B Plant Steam Condensate
WHC-EP-0342	Addendum 17	B Plant Process Condensate
WHC-EP-0342	Addendum 18	2101-M Laboratory Wastewater
WHC-EP-0342	Addendum 19	UO_3 Plant Process Condensate
WHC-EP-0342	Addendum 20	PUREX Plant Cooling Water
WHC-EP-0342	Addendum 21	242-A Evaporator Cooling Water
WHC-EP-0342	Addendum 22	B Plant Cooling Water
WHC-EP-0342	Addendum 23	241-A Tank Farm Cooling Water
WHC-EP-0342	Addendum 24	284-E Powerplant Wastewater
WHC-EP-0342	Addendum 25	244-AR Vault Cooling Water
WHC-EP-0342	Addendum 26	242-A Evaporator Steam Condensate
WHC-EP-0342	Addendum 27	284-W Powerplant Wastewater
WHC-EP-0342	Addendum 28	400 Area Secondary Cooling Water
WHC-EP-0342	Addendum 29	242-S Evaporator Steam Condensate
WHC-EP-0342	Addendum 30	241-AY/AZ Tank Farms Steam Condensate
WHC-EP-0342	Addendum 31	209-E Laboratory Reflector Water
WHC-EP-0342	Addendum 32	T Plant Laboratory Wastewater
WHC-EP-0342	Addendum 33	183-D Filter Backwash Wastewater

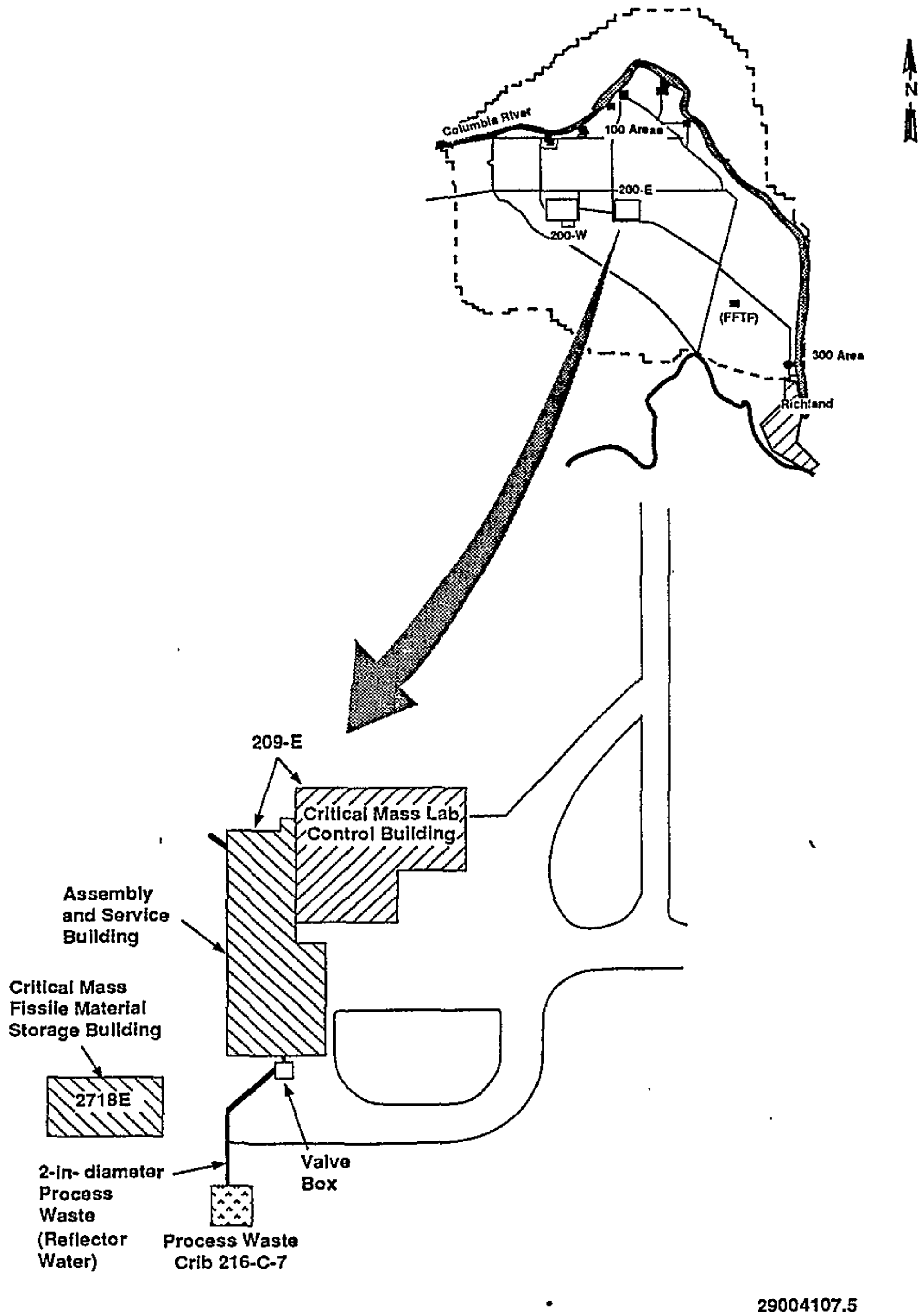
Figure 1-1. Characterization Strategy.



1.3 SCOPE

The scope of this report is the characterization of the 209-E Laboratory reflector effluent that previously entered the soil column at the 216-C-7 Crib. An aerial view of these facilities is shown in Figure 1-2. At the present time, the 209-E Critical Mass Laboratory (CML) is closed and this wastestream is no longer operating. This report does not address any other 209-E Laboratory wastestream, such as solid waste, gaseous waste, or sanitary waste. This report does not include steam condensate and process water discharged to the 221-C excavation.

Figure 1-2. Aerial View of the 209-E Critical Mass Laboratory.



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2.0 PROCESS KNOWLEDGE

This section presents a qualitative and quantitative process-knowledge-based characterization of the chemical and radiological constituents of the 209-E Laboratory reflector water. This process information is discussed in terms of the following factors:

1. Location and physical layout of the process facility
2. A general description of the present, past, and future activities of the process
3. The identity of the wastestream contributors
4. The identity and concentration of the constituents of each contributor.

2.1 PHYSICAL LAYOUT

The 209-E CML was constructed between 1959 and 1960 by the General Electric Corporation (GE). During this time, the 216-C-7 Receiving Crib was also built. The main laboratory building is housed in Building 209-E. The majority of Building 209-E is cinder block construction with the critical assembly room built with a 2-ft-thick roof and 3-ft- to 5-ft-thick concrete walls. Building 209-E was designed to perform various critical mass experiments using plutonium nitrate solutions and enriched uranium. Building 209-E was operated by GE until 1965 at which time Pacific Northwest Laboratory took over operations.

Pacific Northwest Laboratory operated Building 209-E from 1965 until 1988 when it was permanently shut down. During peak operating years, the laboratory housed a staff of 12 (including scientists, technicians, and craftsmen) and performed up to 50 criticality experiments each year. The facility is scheduled for transfer to the Surplus Facilities Management Program in October 1990.

2.2 CONTRIBUTORS

Two sources feed the 209-E Laboratory reflector water wastestream. These are two neutron reflector tanks (600- and 320-gal nominal capacity) in the critical assembly room, both of which serve the same general purpose. Only one tank at a time was used, depending upon the type of experiment.

Each of the tanks is rectangular and holds smaller tanks. The small tanks contained nitric acid solutions of plutonium (at 5 to 200 g/L concentration) and uranium. These solutions sometimes contained small amounts of neutron poisons, such as boron, cadmium, and gadolinium. The interstitial space between the critical mass tanks and the reflector tanks was filled with treated water (or occasionally raw water) during critical mass experiments. This water acted as both a neutron shield and reflector during criticality experiments. This water was drained from the tanks following the experiments.

Piping diagrams indicate that these tanks were sometimes drained via a 2-in.-dia drain line that runs due south through a valve box to a buried 60-gal-capacity holdup tank directly outside the building (see Figure 2-1). Prior to 1985, drains from the mix room and the critical assembly room were also routed to the 216-C-7 Crib. However, these drains have now been sealed.

Appendix A lists piping system components for the laboratory.

2.3 PROCESS DESCRIPTIONS

This section describes the process in terms of present, past, and future activities.

2.3.1 Present Activities

Presently, the CML is closed and locked, and no reflector tank water is being discharged from the facility. Several times each year, personnel enter the facility to conduct maintenance inspections and inventory special nuclear material.

2.3.2 Past Activities

From 1960 through 1983, the CML was actively conducting criticality experiments with plutonium nitrate and enriched uranium solutions. Experiments were also performed using solid special nuclear materials and fuels. During this time period, the number of experiments performed in the CML averaged 15 times per year with a maximum of 50 times per year.

Upon the completion of an experiment or a series of experiments in which one of the neutron reflector tanks was used, the tank water was sampled and analyzed prior to release to the 216-C-7 Crib. The following procedure was used: Several samples were taken by a PNL Health Physics technologist (HPT) of the water in the reflector tank. These samples were drawn from the tank discharge valve and also collected with a dipper from the tank surface. Sample containers used were 10 mL, polyurethane bottles with screw closures. Some of these samples were analyzed for alpha activity immediately, whereas other samples were sent to Hanford Environmental Health Foundation (HEHF) as back-up or duplicates. For the samples that were analyzed in the CML, the sample was transferred to a planchet and evaporated to dryness under a heat lamp. The alpha activity was then measured with a particle counter. The reading was recorded in a log book.

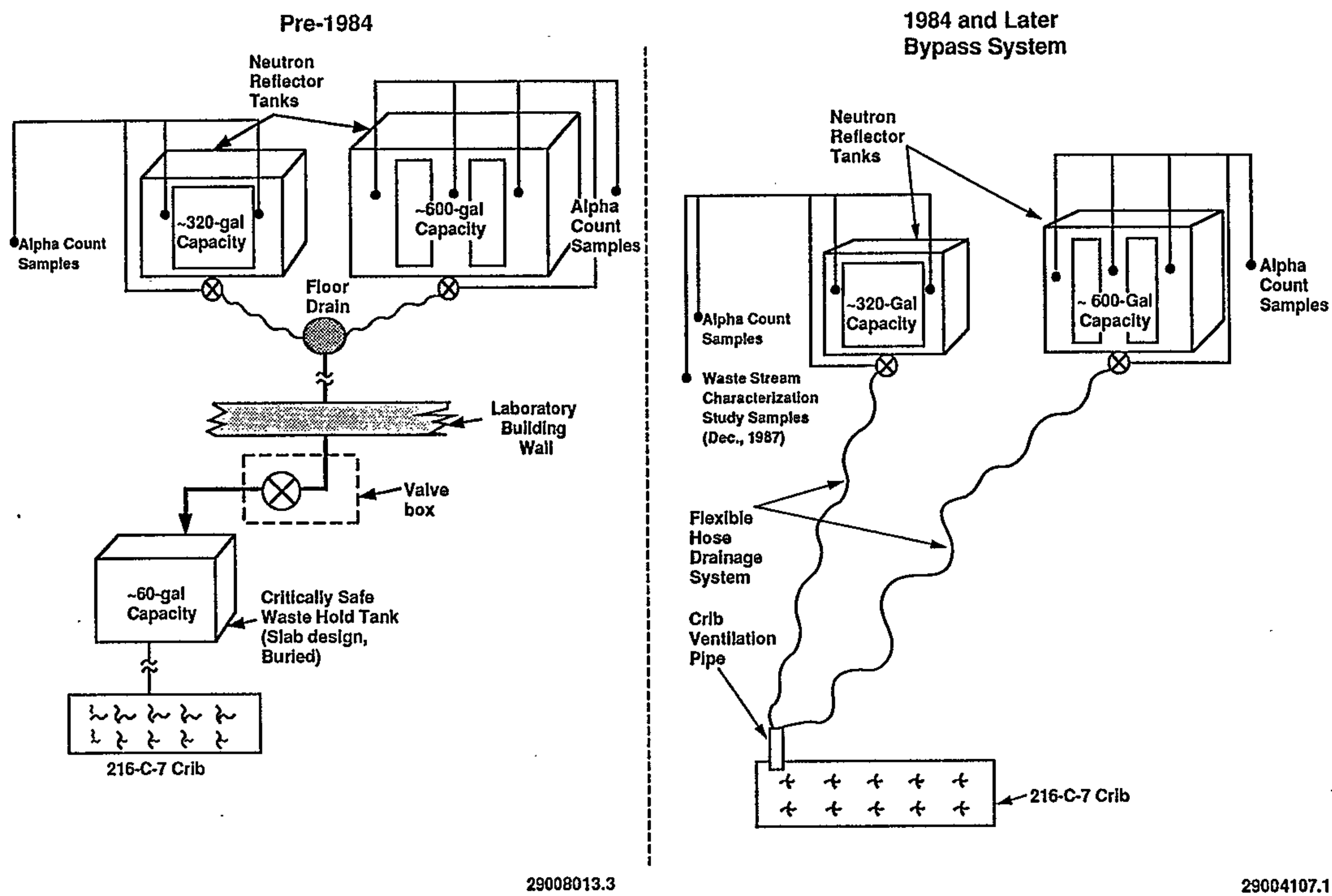

Figure 2-1. 209-E Laboratory Reflector Water Flow Diagram.

Note: Each reflector tank contains one or two smaller tanks which were used to contain plutonium nitrate or uranium solutions. The original plumbing shows that each reflector tank could drain into floor drains in the critical assembly room. These floor drains drained into a 2-in. cast iron pipe which emptied to 60-gal. buried waste hold tank. This waste tank could be pumped directly to the 216-C-7 Crib. <u>Floor drains and a 2-in. drain pipe were sealed in 1984.</u>

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Several readings were taken and compared to a concentration guide compiled from DOE-RL Order 5480.1 (DOE-RL 1982), Change 2, April 29, 1981, Attachment XI-I. This concentration guide lists ^{239}Pu concentration at 800 pCi/mL. Typically, the sample alpha counts were well below that level. The reflector tank water was then discharged via a 2-in.-dia process drain line and a 60-gal buried catch tank to the 216-C-7 Crib (see Figure 2-1). The HEHF duplicate sample analyses confirmed the alpha readings obtained by the HPT.

Beginning in 1984, several important changes were made in the CML piping system. These changes resulted from concerns about the potential to discharge plutonium or uranium to the environment. In response to these concerns, the process drain line was capped and all floor drains from the mix and critical assembly rooms were permanently sealed. Also in 1984, reflector tank discharges were reduced to about five times per year.

After sampling and alpha analysis (as described above), reflector tanks were drained to the crib via a flexible hose and pump. The water was channeled into a crib ventilation pipe. Water was last discharged from the 320-gal reflector tank in this manner in December 1987. At that time, additional samples were taken for analysis by Westinghouse Hanford Company personnel as part of the Liquid Effluent Study (Lawrence 1989). Representative samples were taken directly from the reflector tank as the tank was allowed to drain. These samples were analyzed by the contract laboratory and the results are presented in this report.

2.3.3 Future Activities

There are no plans to operate the CML in the future. The CML is scheduled for listing with the Surplus Facilities Management Program in October 1990 and will be decommissioned and decontaminated in the future.

2.4 PROCESS DATA

The laboratory uses raw and sanitary water in various operations. The origin of this water is the Columbia River. River water is pumped to a large reservoir located in the 100-B Area. Export water systems transfer the water to a 3-Mgal reservoir in the 200 East Area where it is filtered, treated with 5% alum, clarified, and chlorinated (residual, or free, chlorine is 1.5 ppm). The treated water is then stored in two 100,000-gal-capacity concrete-lined, covered reservoirs until needed. Sanitary water is distributed via a 3,200-gal/min-capacity system within the 200 East Area.

The chemical background data set consists of samples taken over a 10-month period of raw untreated Columbia River water. Sanitary water data obtained by Hanford Environmental Health Foundation are included for the 1985-1988 time period. A summary of these data is contained in Appendix C.

Sanitary water or raw water was used to fill the reflector tanks. Because no chemicals are added to these tanks, the only other sources of analytes are corrosion products.

However, because of their construction and operating temperatures, the reflector tanks are unlikely to produce those products. The large reflector tank is constructed of American Society for Testing and Materials (ASTM) A-36 mild steel with Lexan plastic ports and cover. The interior of the tank is coated with a white enamel paint to reduce corrosion. Water remained in the tank for less than 1-wk periods (a further precaution against corrosion). The other tank is a slab design and constructed of stainless steel and glass without any coatings. This tank also would have a very low corrosion potential.

Wastestream flow volumes entering the 216-C-7 Crib are illustrated in Figure 2-2. Note that up to 8,000 L each year were discharged to the crib in the early 1960's. Volumes decreased rapidly from 1975 to 1983. These data were obtained from the Crib Waste Management System database.

Figure 2-2. Effluent Volume to 216-C-7 Crib.

3.0 SAMPLE DATA

This section presents the sample data pertaining to the 209-E Laboratory reflector water wastestream. These data are divided into two categories--wastestream data and supply (raw) water data. The discussion identifies the source of the samplings (Section 3.1) and presents the data (Section 3.2).

3.1 DATA SOURCE

This section discusses the sampling data from the wastestream. Samples for chemical and radionuclide analysis presented in this report were taken directly from the reflector tanks. Sampling during the preparation of this report was not possible because the facility was not operating.

The chemical and radiological data set comprises three samples that were taken during December 1987. This data is contained in Appendix B of this report and Volume 2 of the *Wastestream Characterization Report* (WHC 1989). All samples were taken to a contract laboratory for analysis. The details of the sampling, analytical, quality control, and quality assurance procedures used are contained in Volume 4 of WHC (1989).

Raw water and sanitary water data for this report are presented in Appendix C, "200 East Area Raw Water and Sanitary Water Data."

3.2 DATA PRESENTATION

Both organic and inorganic analytes were identified in the samples. Most of these organic analytes were compiled from a combined mass spectral library from the EPA, the National Institute of Occupational Safety and Health, and the National Bureau of Standards. This library is composed of approximately 40,000 chemical constituents, each with a unique signature on a gas chromatograph/mass spectrometer analysis. The balance were inorganic analytes, such as metals, where other methods such as inductively coupled plasma, ion chromatography, and ion-specific electrode were used.

3.2.1 Statistical Summary

A statistical analysis of both chemical and radiological data sets was performed (see Table 3-1). This analysis included determining the average (mean), maximum, and the upper limit of the 90% confidence interval (90%CI) values of each data set. Statistical methods are referenced and described in *Wastestream Designation of Liquid Effluent Analytical Data* (WHC 1990C). Analytical procedures are listed in Table 3-2.

Table 3-1. Statistics for 209-E Laboratory Reflector Water.

Constituent	N	MDA	Method	Mean	StdErr	90%CILim	Maximum
Barium	3	0	n/a	3.80E+01	2.20E-06	3.80E+01	3.80E+01
Calcium	3	0	n/a	1.97E+04	9.50E+02	2.15E+04	2.07E+04
Chloride	3	0	n/a	1.06E+03	8.30E+01	1.22E+03	1.22E+03
Copper	3	0	n/a	2.90E+01	7.02E+00	4.22E+01	4.30E+01
Fluoride	3	0	n/a	1.28E+02	1.45E+00	1.30E+02	1.30E+02
Iron	3	0	n/a	1.11E+02	1.39E+01	1.37E+02	1.38E+02
Lead	3	0	n/a	9.00E+00	3.89E-07	9.00E+00	9.00E+00
Magnesium	3	0	n/a	4.48E+03	1.16E+02	4.70E+03	4.62E+03
Manganese	3	0	n/a	3.07E+01	4.26E+00	3.87E+01	3.90E+01
Potassium	3	0	n/a	7.16E+02	1.03E+01	7.35E+02	7.31E+02
Sodium	3	0	n/a	2.13E+03	4.33E+01	2.21E+03	2.20E+03
Strontium	3	0	n/a	9.63E+01	3.33E-01	9.70E+01	9.70E+01
Sulfate	3	0	n/a	1.04E+04	1.92E+02	1.07E+04	1.06E+04
Uranium	3	0	n/a	6.03E-01	7.51E-02	7.45E-01	7.47E-01
Zinc	3	0	n/a	1.76E+02	1.73E+01	2.08E+02	2.08E+02
Alpha Activity (pCi/L)	3	0	n/a	7.88E-01	9.82E-02	9.73E-01	9.83E-01
Beta Activity (pCi/L)	3	0	n/a	1.81E+00	6.85E-01	3.11E+00	3.03E+00
Conductivity (µS)	3	0	n/a	2.30E+02	3.90E+01	3.04E+02	3.08E+02
pH (dimensionless)	3	0	n/a	7.34E+00	3.33E-03	7.35E+00	7.35E+00
Temperature (°C)	3	0	n/a	2.21E+01	1.67E-01	2.24E+01	2.24E+01
TOC	3	0	n/a	1.30E+03	1.76E+02	1.63E+03	1.65E+03

Mean values, standard errors, confidence interval limits and maxima are in ppb (parts per billion) unless indicated otherwise.

The column headed MDA (Minimum Detectable Amount) is the number of results in each data set below the detection limit.

The column headed Method shows the MDA replacement method used: replacement by the detection limit (DL), replacement of single-valued MDAs by the log-normal plotting position method (LM), or replacement of multiple valued MDAs by the normal plotting position method (MR).

The column headed "90%CILim" (90% Confidence Interval Limit) is the lower limit of the one-tailed 90% confidence interval for all ignitability data sets and pH data sets with mean values below 7.25. For all other data sets it is the upper limit of the one-tailed 90% confidence interval.

The column headed "Maximum" is the minimum value in the data set for ignitability, the value furthest from 7.25 for pH, and the maximum value for all other analytes.

Table 3-2. Procedures for 209-E Laboratory Reflector Water Samples.

LEAD #	50362	50364	50366
C of C#	50362	50364	50366
Alpha counting	X	X	X
Ammonia	X	X	X
Atomic emission spectroscopy	X	X	X
Beta counting	X	X	X
Conductivity-field	X	X	X
Cyanide	X	X	X
Direct aqueous injection (GC/MS)	X	X	X
Fluoride (LDL)	X	X	X
Hydrazine	X	X	X
Ion chromatography	X	X	X
Lead	X	X	X
Mercury	X	X	X
pH-field	X	X	X
Semivolatile organics (GC/MS)	X	X	X
Sulfide	X	X	X
Temperature-field	X	X	X
Total organic carbon	X	X	X
Total organic halides (LDL)	X	X	X
Uranium	X	X	X
Volatile organics (GC/MS)	X	X	X
LEAD#	50362B	50364B	50366B
C of C#	50363	50365	50367
Volatile organics (GC/MS)	X	X	X

NOTES: Procedures that were performed for a given sample are identified by an "X". Procedure references appear with the data. LEAD # is the Liquid Effluent Analytical Data number that appears in the data reports. C of C # is the chain-of-custody number.

GC = gas chromatography.
LDL = low-detection limit.
MS = mass spectrometry.

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4.0 DATA OVERVIEW

The purpose of this section is to compare sampling data with other baseline information (such as raw or sanitary water data) or "screening" values, such as drinking water standards (DWS) and derived concentration guidelines (DCG) for radionuclides. This comparison will place the quality and character of the 209-E Laboratory reflector water into perspective.

4.1 DATA COMPARISON

Table 4-1 presents the ratio obtained by dividing sampling data by the raw water data. Note that none of these ratios exceed 3.2 (with the exception of zinc at 9), indicating a close similarity between the two data sets.

Table 4-2 compares the sample data averages with both the DWSs (in the form of maximum concentration levels [MCL]) and DCGs. Note that the sample data are generally 1 to 2 orders of magnitude lower than these standards.

4.2 STREAM DEPOSITION RATES

Table 4-3 provides deposition rates using the sample data averages from Table 3-1 adjusted according to the small reflector tank volume. This volume was equal to 320 gal (or 1,210 L) (the amount discharged from the tank during each sample collection in December 1987).

Table 4-1. Comparison of Supply Water Data with the 209-E Laboratory Reflector Water Data.

Parameters/constituents	Supply Water[a] (ppb)	Sampling data[b] (ppb)	Ratio[c]
	Average	Average	
Generic Indicators/misc.			
Alpha Activity (pCi/L)	8.9 E-01	7.9 E-01	0.9
Beta Activity (pCi/L)	4.5 E+00	1.8 E+00	0.4
Conductivity[d] (µS)	9.3 E+01	2.3 E+02	2.5
pH[d]	7.4 E+00	7.3 E+00	1.0
Temperature[d] (°C)	1.6 E+01	2.2 E+01	1.4
Total organic carbon (TOC)	1.4 E+03	1.3 E+03	0.9
Cations			
Barium	2.8 E+01	3.8 E+01	1.4
Calcium	1.8 E+04	2.0 E+04	1.1
Copper	1.1 E+01	2.9 E+01	2.6
Iron	6.4 E+01	1.1 E+02	1.7
Lead	NA	9.0 E+00	NA
Magnesium	4.2 E+03	4.5 E+03	1.1
Manganese	9.8 E+00	3.1 E+01	3.2
Potassium	8.0 E+02	7.2 E+02	0.9
Sodium	2.3 E+03	2.1 E+03	0.9
Uranium	7.3 E-01	6.0 E-01	0.8
Zinc	2.0 E+01	1.8 E+02	9.0
Anions			
Chloride	8.7 E+02	1.1 E+03	1.3
Fluoride	NA	1.3 E+02	NA
Sulfate	1.1 E+04	1.0 E+04	0.9

[a] Both sanitary and raw water were used to supply the reflector tanks. Therefore, the lowest value for each analyte is presented here from the combined data set (see Appendix C).

[b] Sampling data were obtained from Table 3-1.

[c] Sampling data divided by Supply water data.

[d] Measurements taken in the field.

NA = Data not available.

Table 4-2. Evaluation of 209-E Laboratory Reflector Water.

Constituent	Result[a]	SV1[b]	SV2[c]
Barium	3.8E-02	5.0E+00 g	
Chloride	1.1E+00	2.5E+02 h	
Copper	2.9E-02	1.0E+00 h	
Fluoride	1.3E-01	2.0E+00 g	
Iron	1.1E-01	3.0E-01 h	
Lead	9.0E-03	5.0E-02 g	
Manganese	3.1E-02	5.0E-02 h	
Sulfate	1.0E+01	2.5E+02 h	
Zinc	1.8E-01	5.0E+00 h	
Alpha Activity (pCi/L)[n]	7.9E-01	1.5E+01 g	3.0E+01
Beta Activity (pCi/L)[o]	1.8E+00		1.0E+03

[a]Units of results are mg/L unless indicated otherwise. The results are the mean values reported in the Statistics table of Section 3.0.

[b]Screening Value 1 (SV1) lists the value first, basis second and an asterisk (*) third if the result exceeds the regulatory value. The basis is the proposed primary MCL (e), the proposed secondary MCL (f), the primary MCL (g), or the secondary MCL (h). The value is the smaller of two MCLs: the proposed primary MCL (or the primary MCL as a default) or the proposed secondary MCL (or the secondary MCL as a default). See WHC-EP-0342, *Hanford Site Stream-Specific Reports*, August 1990.

[c]Screening Value 2 (SV2) lists the value first and an asterisk (*) second if the result exceeds the SV2). These values are derived concentration guides obtained from Appendix A of WHC-CM-7-5, *Environmental Compliance*, January 1990.

[n]The SV1 and SV2 values for Gross Alpha are used to evaluate Alpha Activity.

[o]The SV2 for Gross Beta is used to evaluate Beta Activity.

Table 4-3. Deposition Rate for 209-E Laboratory Reflector Water Flowrate: 1.21 E+03 L/test.

Constituent	Kg/L*	Kg/mo*
Barium	3.80E-08	4.60E-05
Calcium	1.97E-05	2.39E-02
Chloride	1.06E-06	1.28E-03
Copper	2.90E-08	3.51E-05
Fluoride	1.28E-07	1.55E-04
Iron	1.11E-07	1.34E-04
Lead	9.00E-09	1.09E-05
Magnesium	4.48E-06	5.43E-03
Manganese	3.07E-08	3.72E-05
Potassium	7.16E-07	8.67E-04
Sodium	2.13E-06	2.58E-03
Strontium	9.63E-08	1.17E-04
Sulfate	1.04E-05	1.26E-02
Uranium	6.03E-10	7.30E-07
Zinc	1.76E-07	2.13E-04
Alpha Activity *	7.88E-13	9.54E-10
Beta Activity *	1.81E-12	2.19E-09
TOC	1.30E-06	1.57E-03

Data collected during three tests in December 1987. Flowrate is the average of rates from Section 2.0. Constituent concentrations are average values from the Statistics Report in Section 3.0. Concentration units of flagged (*) constituents are reported as curies per liter. Deposition rate units of flagged (*) constituents are reported as curies per test.

5.0 DESIGNATION

This section proposes that the 209-E Laboratory Reflector water wastestream not be designated a dangerous waste. This proposed designation uses data from both the effluent source description and sample data (Sections 2.0 through 4.0) and complies with the designation requirements of WAC 173-303-070.

The procedure for determining whether a waste is a dangerous waste is contained in the Washington State *Dangerous Waste Regulations* (WAC 173-303). This procedure is illustrated in Figure 5-1 and includes the following:

- Dangerous Waste Lists (WAC 173-303-080)
- Dangerous Waste Criteria (WAC 173-303-100)
- Dangerous Waste Characteristics (WAC 173-303-090).

5.1 DANGEROUS WASTE LISTS

A waste is considered a listed dangerous waste if it either contains a discarded chemical product (WAC 173-303-081) or originates from a dangerous waste source (WAC 173-303-082). The proposed designations were based upon a combination of process knowledge and sample data.

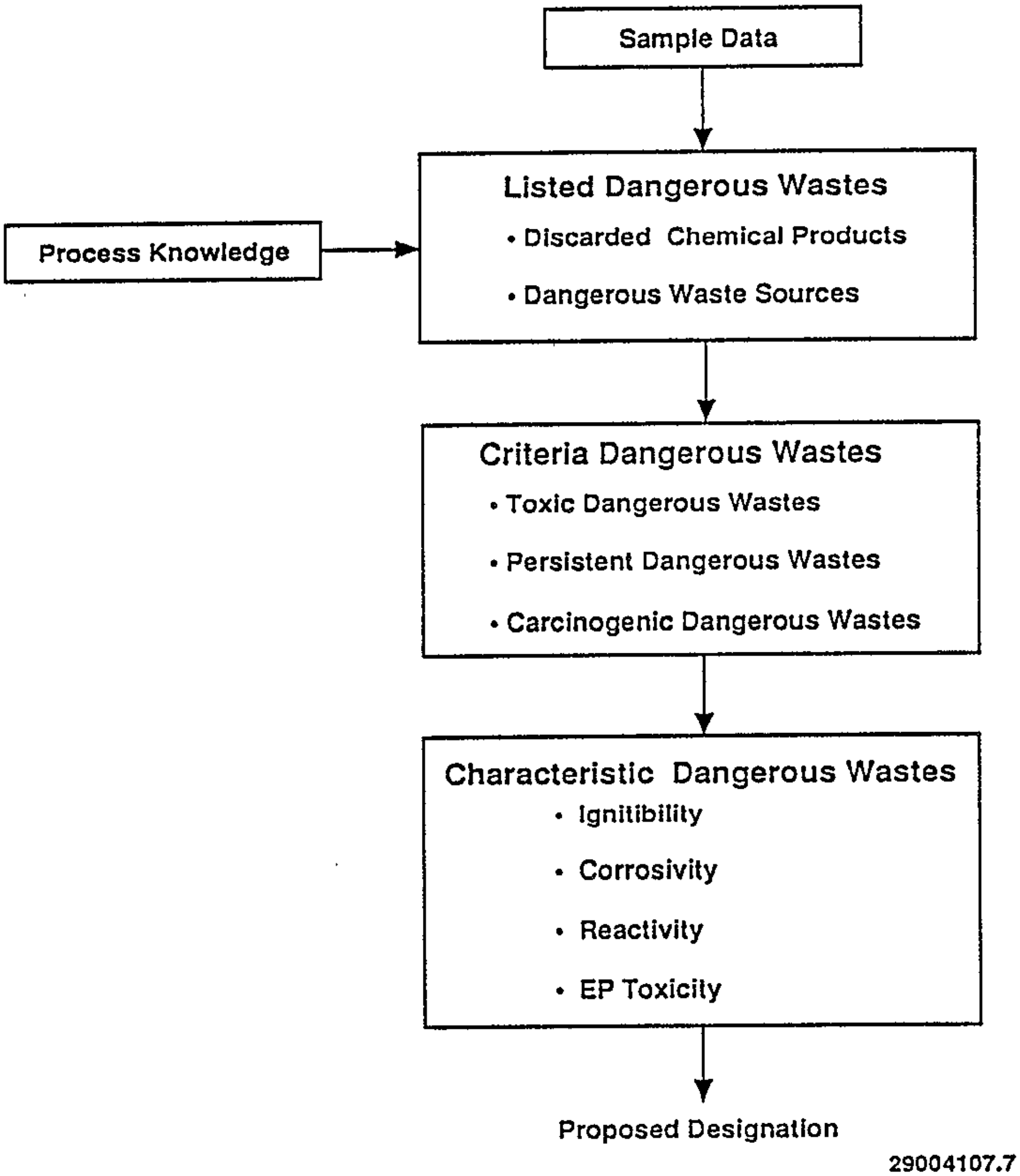
5.1.1 Discarded Chemical Product

A wastestream constituent is a discarded chemical product if it is listed in WAC 173-303-9903 and is characterized by one or all of the following descriptions.

- The listed constituent is the sole active ingredient in a commercial chemical product which has been discarded. Commercial chemical products which, as purchased, contained two or more active ingredients were not designated as discarded chemical products. Products which contained nonactive components such as water, however, were designated if the sole active ingredients in the mixture were listed in WAC 173-303-9903.

- The constituent results from a spill of unused chemicals. A spill of a discarded chemical product would cause a wastestream to be designated during the time that the discharge is occurring. The approach taken is that the current wastestream would not be designated unless a review of past spill events indicates that the spills are predictable, systematic events that are ongoing or are reasonably anticipated to occur in the future. In this report,

Figure 5-1. The Designation Procedure.



the evaluation of this criterion is based on a review of spill data according to the *Comprehensive Environmental Response, Compensation, and Liability Act* (EPA 1980).

- The constituent is discarded in the form of a residue resulting from cleanup of a spill of an unused commercial chemical product on the discarded chemical products list. A chemical product that is used in a process and then released to a wastestream is not a discarded chemical product. Off-specification, unused chemicals, and chemicals that have exceeded a shelf life, but have not been used, are considered discarded chemical products.

5.1.2 Dangerous Waste Sources

A list of dangerous waste sources is contained in WAC 173-303-9904, pursuant to WAC 173-303-082. There are three major categories of sources in WAC 173-303-9904. The first is nonspecific sources from routine operations occurring at many industries. The second is specific sources (e.g., wastes from ink formulation, etc.). The third is state sources which may be limited to polychlorinated biphenyl (PCB)-contaminated transformers and capacitors resulting from salvaging, rebuilding, or discarding activities.

5.2 LISTED WASTE DATA CONSIDERATIONS

In this report, the proposed designation of the wastestream is based on an evaluation of process and sampling data. The following sections describe the types of information used in this designation.

5.2.1 Process Evaluation

The process evaluation began with a thorough review of the processes contributing to the wastestream. Processes were reviewed and compared with the discarded chemical products list and the dangerous waste source list. This process evaluation was necessary because the stream could be a listed waste if a listed waste was known to have been added at any upstream location, even if a listed constituent was not detected at the sample point. The process evaluation includes a review of the following information sources:

- Process chemical inventories

- Physical inspections, where possible.

Additionally, interviews of appropriate facility personnel have been conducted to determine if there were any procedures or laboratory processes that generated a listed waste that may not have been evident during other portions of the process evaluation.

If a listed chemical was identified, the specific use of the chemical was evaluated to determine if such use resulted in the generation of a listed waste.

5.2.2 Sampling Data

Sampling data were used as screening tools to enhance and support the results of the process evaluation. This step compares the results of the sampling data to the WAC 173-303-9903 and -9904 lists. If a constituent was cited on one or both of these lists, an engineering evaluation was performed to determine if the constituent had entered the wastestream as a discarded chemical product or came from a dangerous waste source.

Screening organic constituents is a relatively simple procedure because analytical data for organic constituents are reported as substances and are easily compared to the WAC 173-303-9903 and -9904 lists. It is not as simple to screen inorganic analytical data because inorganic data are reported as ions or elements rather than as substances. For example, an analysis may show that a wastestream contains the cations (sodium and calcium) along with the anions (chloride and nitrate). The possible combinations of substances include: sodium chloride, sodium nitrate, calcium chloride, and calcium nitrate. In a situation with many cations and anions, however, the list of possible combinations is extensive.

A procedure was developed by Westinghouse Hanford Company for combining the inorganic constituents into substances. This screening procedure is described in *Wastestream Designation of Liquid Effluent Analytical Data* (WHC 1990c) and is intended to be a tool in the evaluation of a wastestream. The listing of the inorganic substances developed by this screening procedure is not intended to be an indication that the substance was discharged to the wastestream, only that the necessary cations and anions are present and an investigation should be conducted to determine how they entered the wastestream.

Table 5-1 documents how ion analytes were assigned to neutral substances that are required for designation. The table accounts for charge balancing the ion assemblage (from Table 3-1 [the statistical summary]) and the subsequent formulation of neutral substances. A detailed discussion can be found in WHC (1990c).

5.3 PROPOSED LISTED WASTE DESIGNATIONS

A process evaluation, along with a review of sampling data, indicated that the 209-E Laboratory reflector wastewater stream did not contain a discharged chemical product or a listed waste source. The following sections discuss the evaluation that was conducted to substantiate this conclusion.

Table 5-1. Inorganic Chemistry for 209-E Laboratory Reflector Water. (sheet 1 of 2)

Constituent	ppb	Ion	Eq/g	Normalized
Charge normalization:				
Barium	3.80E+01	Ba+2	5.53E-10	
Calcium	2.15E+04	Ca+2	1.07E-06	
Chloride	1.22E+03	Cl-1	3.44E-08	2.07E-07
Copper	4.22E+01	Cu+2	1.33E-09	
Fluoride	1.30E+02	F-1	6.86E-09	4.13E-08
Iron	1.37E+02	Fe+3	7.37E-09	
Lead	9.00E+00	Pb+2	8.69E-11	
Magnesium	4.70E+03	Mg+2	3.87E-07	
Manganese	3.87E+01	Mn+2	1.41E-09	
Potassium	7.35E+02	K+1	1.88E-08	
Sodium	2.21E+03	Na+1	9.61E-08	
Strontium	9.70E+01	Sr+2	2.21E-09	
Sulfate	1.07E+04	SO4-2	2.23E-07	1.34E-06
Uranium	7.45E-01	UO2+2	6.26E-12	
Zinc	2.08E+02	Zn+2	6.37E-09	
Hydrogen Ion (from pH 7.3)		H+	(4.47E-11)	
Hydroxide Ion (from pH)		OH-	(2.24E-10)	
Cation total			1.59E-06	
Anion total			2.65E-07	
Anion normalization factor:	6.019			

Substance formation:

Substance	%	Cation out	Anion out
Copper(II) chloride	8.94E-06	0.00E+00	2.06E-07
Iron(III) fluoride	2.77E-05	0.00E+00	3.39E-08
Lead chloride	1.21E-06	0.00E+00	2.06E-07
Potassium fluoride	1.09E-04	0.00E+00	1.51E-08
Barium chloride	5.76E-06	0.00E+00	2.05E-07
Sodium fluoride	6.36E-05	8.09E-08	0.00E+00
Zinc sulfate	5.14E-05	0.00E+00	1.34E-06
Magnesium chloride	9.76E-04	1.82E-07	0.00E+00
Magnesium sulfate	1.09E-03	0.00E+00	1.16E-06
Manganese(II) sulfate	1.06E-05	0.00E+00	1.15E-06
Strontium sulfate	2.03E-05	0.00E+00	1.15E-06
Sodium sulfate	5.75E-04	0.00E+00	1.07E-06
Uranyl sulfate	1.15E-07	0.00E+00	1.07E-06
Calcium sulfate	7.29E-03	1.30E-09	0.00E+00

Table 5-1. Inorganic Chemistry for 209-E Laboratory Reflector Water.
(sheet 2 of 2)

Statistics based on a single datum are noted by an asterisk (*). With the exception of hydrogen ion and hydroxide, others report the upper limit of the one-tailed 90% confidence interval. Hydrogen ion is based on the lower limit of the one-tailed 90% confidence interval for pH sets with mean values below 7.25 and on the upper limit of the one-tailed 90% confidence interval for pH data sets with mean values of 7.25 or higher. The hydroxide magnitude is equal to 1.00E-20 equivalents per gram (Eq/g)**2 divided by the hydrogen ion value (in Eq/g).

Ion concentrations in Eq/g are based on the statistic. Conversions include scale (ppb to g/g), molecular weight (constituent form to ionic form), and equivalents (charges per ion). The column headed "Normalized" shows normalized concentrations (also in Eq/g) calculated by increasing concentrations of cations, excluding Hydrogen ion, or anions, excluding hydroxide, by the normalization factor. The normalization factor is the larger of the cation total, including Hydrogen ion, or anion total, including hydroxide, divided by the smaller total.

Substance names may include MB (monobasic), DB (dibasic), TB (tribasic) to identify the equivalents of hydrogen ion that have been neutralized from polycrotic weak acids to form their conjugate bases.

Substances are formulated in the order listed. The column headed "%" is the percent of the substance in the waste (gms/100gms). Substances formulated with oxygen are based on the residual concentration of the counterion. Other substance concentrations are based on the limiting residual concentration of the cation or anion. The columns headed "Cation Out" and "Anion Out" indicate the residual concentrations (in Eq/g) of each ion after a substance concentration has been calculated.

5.3.1 Discarded Chemical Products

As discussed in Section 5.2, a process evaluation on the contributors to the 209-E Laboratory reflector wastewater stream was conducted. This evaluation included a review of material safety data sheets (MSDS) at the plant for possible listed waste contributors.

The hydrogen fluoride reported in Table 5-2 is postulated as an artifact of the Westinghouse Hanford Company ion pairing methodology applied to the fluoride reported in the analytical data. Interviews with personnel at the facility confirmed that hydrogen flouride was not used at this facility.

Fluoride appeared in all three of the samples taken of the wastestream in December 1987. The concentration of fluoride in these samples ranged from 125 to 130 ppb. The threshold value for postulated hydrogen fluoride, based on sanitary water supplied to the 200 East Area, is 143 ppb as presented in Section 5.2 of this document. Because the concentration of fluoride seen in all the sample results is less than the threshold value for hydrogen fluoride, these data will not be considered as a postulated compound in the designation of the wastestream as it is likely that fluoride is present in the water supplied to the 209-E Critical Mass Laboratory.

5.3.2 Dangerous Waste Sources

The process evaluation (see Section 5.2) was also used to determine if the wastestream included any specific waste sources (K wastes) or any nonspecific waste sources (F wastes) in the Dangerous Waste Source List WAC 173-303-9904.

Sampling data were utilized to enhance the process evaluation. No potential listed waste source constituents were identified by the sampling data (see Table 5-2).

5.4 DANGEROUS WASTE CRITERIA

A waste is considered a dangerous waste if it meets any of the following criteria categories (WAC 173-303-100): toxic dangerous waste, persistent dangerous waste, or carcinogenic dangerous waste. A description of the methods used to test the sampling data against the criteria is contained in WHC (1990c). Summaries of the methods, along with the results, are contained in the following sections.

5.4.1 Toxic Dangerous Waste

The procedure for determining if a wastestream is a toxic dangerous waste (WAC 173-303-101) is as follows.

- Collect and analyze multiple samples from the wastestream.

Table 5-2. Dangerous Waste Data Designation Report for 209-E Laboratory Reflector Water. (sheet 1 of 2)

Dangerous Waste Data Designation Report for 209-E Laboratory Reflector Water

Finding: Undesignated

Discarded Chemical Products - WAC 173-303-081

Substance	Review Number	Status	DW Number
Hydrogen fluoride	U134(DW)	Not Discarded	Undesignated

Dangerous Waste Sources - WAC 173-303-082

Substance	Review Number	Status	DW Number
None	None	Not applicable	None

Infectous Dangerous Waste - WAC 173-303-083

No regulatory guidance

Dangerous Waste Mixtures - WAC 173-303-084

Substance	Toxic EC%	Persistant HH%	Persistant PAH%	Carcinogenic Total%
Barium chloride	5.76E-09	0.00E+00	0.00E+00	0.00E+00
Copper(II) chloride	8.94E-07	0.00E+00	0.00E+00	0.00E+00
Iron(III) fluoride	2.77E-07	0.00E+00	0.00E+00	0.00E+00
Lead chloride	1.21E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium chloride	9.76E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium sulfate	1.09E-07	0.00E+00	0.00E+00	0.00E+00
Potassium fluoride	1.09E-07	0.00E+00	0.00E+00	0.00E+00
Sodium fluoride	6.36E-08	0.00E+00	0.00E+00	0.00E+00
Zinc sulfate	5.14E-08	0.00E+00	0.00E+00	0.00E+00
Total	1.62E-06	0.00E+00	0.00E+00	0.00E+00
DW Number	Undesignated	Undesignated	Undesignated	Undesignated

Dangerous Waste Characteristics - WAC 173-303-090

Characteristic	Value	DW Number
Corrosivity-pH	7.35	Undesignated
Total Cyanide (mg/kg)	0.00E+00	Undesignated
Total Sulfide (mg/kg)	0.00E+00	Undesignated
Total Barium (mg/L)	3.80E-02	Undesignated
Total Lead (mg/L)	9.00E-03	Undesignated

Dangerous Waste Criteria - WAC 173-303-100

Substance	Toxic EC%	Persistant HH%	Persistant PAH%	Carcinogenic Total%	DW Number-Positive
Barium chloride	5.76E-09	0.00E+00	0.00E+00	0.00E+00	
Copper(II) chloride	8.94E-07	0.00E+00	0.00E+00	0.00E+00	
Iron(III) fluoride	2.77E-07	0.00E+00	0.00E+00	0.00E+00	
Lead chloride	1.21E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium chloride	9.76E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium sulfate	1.09E-07	0.00E+00	0.00E+00	0.00E+00	
Potassium fluoride	1.09E-07	0.00E+00	0.00E+00	0.00E+00	
Sodium fluoride	6.36E-08	0.00E+00	0.00E+00	0.00E+00	
Zinc sulfate	5.14E-08	0.00E+00	0.00E+00	0.00E+00	
Total	1.62E-06	0.00E+00	0.00E+00	0.00E+00	
DW Number	Undesignated	Undesignated	Undesignated	Undesignated	

Table 5-2. Dangerous Waste Data Designation Report for 209-E Laboratory Reflector Water. (sheet 2 of 2)

Dangerous Waste Data Designation Report for 209-E Laboratory Reflector Water

Dangerous Waste Constituents - WAC 173-303-9905

Substance
Hydrogen fluoride
Barium and compounds,NOS
Lead and compounds,NOS

Substance names may include MB (monobasic), DB (dibasic), or TB (tribasic) to identify the equivalence of hydrogen ion that have been nutralized from polyprotic weak acids to form their conjugate bases.
Results based on a single datum are noted by an asterisk (*). Others are based on the lower limit of the one-tailed 90% confidence interval for pH data sets with mean values below 7.25 or by the upper limit of the one-tailed 90% confidence interval for all other data sets.
EP Toxic contaminants, ignitability, and reactivity are reported by standard methods when available. In the absence of EP Toxicity data, total contaminant concentrations are evaluated. In lieu of closed cup ignition results, ignitability is estimated from the sum of the contributions of all substances that are ignitable when pure. A waste is flagged as dangerous if sum of the ignitable substances exceeds one percent. Reactivity is by SW-846: 250 mg of cyanide as hydrogen cyanide per kg of waste or 500 mg of sulfide as hydrogen sulfide per kg of waste. Total cyanide and total sulfide are used in lieu of amenable cyanide and amenable sulfide.

Inorganic substances are fomulated and their possible concentrations calculated for designation purposes only. The actual existance in the waste of these substances is not implied and should not be infered.

- Calculate the upper limit of the 90%CI for each analyte in the wastestream.

- Formulate substances from the analytical data. NOTE: This step is only required for inorganic analytes since it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC (1990c) and is based on an evaluation of the most toxic substances that can exist in an aqueous environment under normal temperatures and pressures.

- Assign toxic categories to the substances detected or, in the case of inorganic analytes, postulated to be in the wastestream.

- Calculate the contribution of each substance to the percent equivalent concentration (EC%).

- Calculate the EC% by summing the contributors of each substance.

- Designate the wastestream as a toxic dangerous waste if the EC% is greater than 0.001%, per WAC 173-303-9906.

Nine substances potentially present in the 209-E Laboratory reflector wastewater stream were determined to have toxic categories associated with them (see Table 5-2). The individual and sum EC% contributions for these substances are listed in Table 5-2. Since the EC% is 1.6 E-08, which is less than the cutoff of 1.0 E-03 (i.e., 0.001%), the wastestream is not a toxic dangerous waste.

5.4.2 Persistent Dangerous Wastes

The procedure for determining if a wastestream is a persistent dangerous waste is as follows (WAC 173-303-102):

- Collect multiple grab samples of the wastestream

- Determine which substances in the wastestream are halogenated hydrocarbons (HH) and which are polycyclic aromatic hydrocarbons (PAH)

- Determine the upper limit of the one-sided 90%CI for the substances of interest

- Calculate for the weight percent (wt%) contribution of each HH and PAH separately

- Sum the resulting wt% contributions to HH% and PAH% separately

- Designate the wastestream as persistent if the HH% is greater than 0.01% or if the PAH% is greater than 1.0%, per WAC 173-303-9907.

No HH or PAH were found (see Table 5-2). Therefore, the 209-E Laboratory reflector wastewater stream is not a persistent dangerous waste.

5.4.3 Carcinogenic Dangerous Wastes

The procedure for determining if a wastestream is a carcinogenic dangerous waste is as follows (WAC 173-303-103).

- Collect multiple grab samples of the wastestream.
- Determine the upper limit of the one-sided 90%CI for the substances of interest.
- Formulate substances from the analytical data. NOTE: This step is only required for inorganic analytes since it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC (1990c) and is based on an evaluation of the most toxic substances that can exist in an aqueous environment under normal temperatures and pressures.
- Determine which substances in the wastestream are human or animal carcinogens according to the International Agency for Research on Cancer.
- Calculate the wt% concentration for each carcinogen.
- Sum the resulting wt% contributions.
- Designate the wastestream as carcinogenic if any of the positive carcinogens are above 0.01% or if the total concentration for positive and suspected carcinogens is above 1.0%.

No carcinogenic chemicals were detected (see Table 5-2). Therefore, 209-E Laboratory reflector wastewater stream is not a carcinogenic dangerous waste.

5.5 DANGEROUS WASTE CHARACTERISTICS

A waste is considered a dangerous waste if it is ignitable, corrosive, reactive, or extraction procedure (EP) toxic (WAC 173-303-090). A description of the methods used to evaluate the data in terms of these characteristics is contained in WHC 1990c. Summaries of the methods, along with the results, are contained in the following sections.

5.5.1 Ignitability

Because of the dilute aqueous nature of these wastes, flashpoint testing was not performed during the initial samples collected from the wastestream. Instead, an ignitability index was calculated for the samples and was based on the sum of the percent concentrations of all ignitable substances in the waste. Pure substances with a flashpoint <140 °F were considered ignitable. Samples with ignitability indexes below 1% were not considered ignitable.

No substance potentially present in the 209-E Laboratory reflector wastewater stream is an ignitable substance (see Table 5-2). Therefore, the 209-E Laboratory reflector wastewater stream is not an ignitable waste.

5.5.2 Corrosivity

A waste is a corrosive dangerous waste if it has a pH of ≤2.0 or ≥12.5. The comparison to this characteristic was based on the lower limit of the one-sided 90%CI for a stream with a mean value of pH <7.25 and the upper limit of the one-sided 90%CI for a stream with a mean value of pH >7.25.

Because the mean value of the pH measurements for the 209-E Laboratory reflector water is above 7.25, the upper limit of the confidence interval, 7.34, is used. The wastestream is not a corrosive dangerous waste (WAC 173-303-090[6]).

5.5.3 Reactivity

An aqueous waste is reactive if the waste contains an amount of cyanide or sulfide under conditions near corrosivity sufficient to threaten human health or the environment (WAC 173-303-090[7]). A recent revision to test methods for evaluating solid waste (SW-846) (EPA 1986) provides a more quantitative indicator level for cyanide and sulfide. It states that levels of (equivalent) cyanide below 250 mg/kg or of (equivalent) sulfide below 500 mg/kg would not be considered reactive.

For samples collected before July 1989, total cyanide and total sulfide were used to evaluate reactivity.

Total cyanide and total sulfide in this wastestream were below the 100 mg/kg detection limit. The wastestream is not a reactive dangerous waste.

5.5.4 Extraction Procedure Toxicity

A waste is an EP toxic dangerous waste if individual chemical analytes exceed limits of WAC 173-303-090(8)(c). In the absence of specific EP toxicity test results, total analyte concentrations are used. Two analytes with concentrations above detection limits that are on the EP toxic list were found in the 209-E Laboratory reflector wastewater stream. The concentrations of these two analytes are listed in Table 5-2. Because the barium concentration of 3.80 E-02 mg/L does not exceed the limit of 100 mg/L, and the lead concentration of 9.00 E-03 mg/L does not exceed the limit of 5 mg/L, the 209-E Laboratory reflector wastewater stream is not an EP toxic dangerous waste.

5.6 PROPOSED DESIGNATION

Because the 209-E Laboratory reflector wastewater stream does not contain any dangerous waste, as defined in WAC 173-303-070, it is proposed that the wastestream not be designated a dangerous waste.

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6.0 ACTION PLAN

No future samples or characterization is warranted for this effluent since the facility is permanently closed. The Critical Mass Laboratory is currently scheduled to be turned over to the Westinghouse Hanford Company Surplus Facilities Program in October 1990. Final decontamination and decommissioning of the facility will be scheduled at that time.

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APPENDIX A

LIST OF PIPING SYSTEM COMPONENTS THAT CONTRIBUTE TO THE 216-C-7 CRIB

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Table A-1. List of Piping System Components that Contribute to 216-C-7 Crib.

Potential contributor	Number	Location
Building 209-E (CML)		
Neutron shield tank, 600-gal-capacity	1	Critical assembly room
Slab Tank, 320-gal-capacity	1	Critical assembly room
Floor drains	2*	Critical assembly room - hoods
	1*	Critical assembly room
Cleanouts	1	Mix room
Sinks	1*	Changeroom
	2*	Mix room
Subtotal	9	
Outside piping		
Tank 111, critically safe crib waste hold-up tank (60-gal-capacity)	1	South of laboratory
Valve box	1	South of laboratory
Subtotal	2	
216-C-7 Crib		
Vent risers	4	Crib area
Subtotal	4	
Total	15	

*Capped in 1985.

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APPENDIX B

DATA FOR 209-E LABORATORY REFLECTOR WATER

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Table B-1. Data for 209-E Laboratory Reflector Water. (sheet 1 of 4)

Constituent	Sample #	Date	Method	Result
Barium	50362	12/03/87	ICP	3.80E+01
Barium	50364	12/10/87	ICP	3.80E+01
Barium	50366	12/18/87	ICP	3.80E+01
Calcium	50362	12/03/87	ICP	1.78E+04
Calcium	50364	12/10/87	ICP	2.06E+04
Calcium	50366	12/18/87	ICP	2.07E+04
Chloride	50362	12/03/87	IC	9.38E+02
Chloride	50364	12/10/87	IC	1.22E+03
Chloride	50366	12/18/87	IC	1.03E+03
Copper	50362	12/03/87	ICP	2.30E+01
Copper	50364	12/10/87	ICP	4.30E+01
Copper	50366	12/18/87	ICP	2.10E+01
Fluoride	50362	12/03/87	IC	<5.00E+02
Fluoride	50362	12/03/87	ISE	1.30E+02
Fluoride	50364	12/10/87	IC	<5.00E+02
Fluoride	50364	12/10/87	ISE	1.28E+02
Fluoride	50366	12/18/87	IC	<5.00E+02
Fluoride	50366	12/18/87	ISE	1.25E+02
Iron	50362	12/03/87	ICP	1.03E+02
Iron	50364	12/10/87	ICP	1.38E+02
Iron	50366	12/18/87	ICP	9.20E+01
Lead	50362	12/03/87	GFAA	9.00E+00
Lead	50364	12/10/87	GFAA	9.00E+00
Lead	50366	12/18/87	GFAA	9.00E+00
Magnesium	50362	12/03/87	ICP	4.25E+03
Magnesium	50364	12/10/87	ICP	4.57E+03
Magnesium	50366	12/18/87	ICP	4.62E+03
Manganese	50362	12/03/87	ICP	3.90E+01
Manganese	50364	12/10/87	ICP	2.80E+01
Manganese	50366	12/18/87	ICP	2.50E+01
Potassium	50362	12/03/87	ICP	7.31E+02
Potassium	50364	12/10/87	ICP	7.20E+02
Potassium	50366	12/18/87	ICP	6.96E+02
Sodium	50362	12/03/87	ICP	2.05E+03
Sodium	50364	12/10/87	ICP	2.20E+03
Sodium	50366	12/18/87	ICP	2.13E+03
Strontium	50362	12/03/87	ICP	9.60E+01
Strontium	50364	12/10/87	ICP	9.70E+01
Strontium	50366	12/18/87	ICP	9.60E+01
Sulfate	50362	12/03/87	IC	1.05E+04
Sulfate	50364	12/10/87	IC	1.06E+04
Sulfate	50366	12/18/87	IC	9.98E+03
Uranium	50362	12/03/87	FLUOR	5.68E-01
Uranium	50364	12/10/87	FLUOR	4.94E-01
Uranium	50366	12/18/87	FLUOR	7.47E-01

Table B-1. Data for 209-E Laboratory Reflector Water. (sheet 2 of 4)

Constituent	Sample #	Date	Method	Result
Zinc	50362	12/03/87	ICP	1.49E+02
Zinc	50364	12/10/87	ICP	2.08E+02
Zinc	50366	12/18/87	ICP	1.70E+02
1,1,1-Trichloromethane	50362	12/03/87	VOA	<5.00E+00
1,1,1-Trichloromethane	50362B	12/03/87	VOA	9.00E+00
1,1,1-Trichloromethane	50364	12/10/87	VOA	<5.00E+00
1,1,1-Trichloromethane	50364B	12/10/87	VOA	<5.00E+00
1,1,1-Trichloromethane	50366	12/18/87	VOA	<5.00E+00
1,1,1-Trichloromethane	50366B	12/18/87	VOA	<5.00E+00
Trichloromethane	50362	12/03/87	VOA	<5.00E+00
Trichloromethane	50362B	12/03/87	VOA	1.70E+01
Trichloromethane	50364	12/10/87	VOA	<5.00E+00
Trichloromethane	50364B	12/10/87	VOA	<5.00E+00
Trichloromethane	50366	12/18/87	VOA	<5.00E+00
Trichloromethane	50366B	12/18/87	VOA	<5.00E+00
Alpha Activity (pCi/L)	50362	12/03/87	Alpha	9.83E-01
Alpha Activity (pCi/L)	50364	12/10/87	Alpha	6.73E-01
Alpha Activity (pCi/L)	50366	12/18/87	Alpha	7.07E-01
Beta Activity (pCi/L)	50362	12/03/87	Beta	1.75E+00
Beta Activity (pCi/L)	50364	12/10/87	Beta	6.60E-01
Beta Activity (pCi/L)	50366	12/18/87	Beta	3.03E+00
Conductivity (µS)	50362	12/03/87	COND-Fld	3.08E+02
Conductivity (µS)	50364	12/10/87	COND-Fld	1.91E+02
Conductivity (µS)	50366	12/18/87	COND-Fld	1.91E+02
pH (dimensionless)	50362	12/03/87	PH-Fld	7.35E+00
pH (dimensionless)	50364	12/10/87	PH-Fld	7.34E+00
pH (dimensionless)	50366	12/18/87	PH-Fld	7.34E+00
Temperature (°C)	50362	12/03/87	TEMP-Fld	2.24E+01
Temperature (°C)	50364	12/10/87	TEMP-Fld	2.19E+01
Temperature (°C)	50366	12/18/87	TEMP-Fld	2.19E+01
TOC	50362	12/03/87	TOC	1.65E+03
TOC	50364	12/10/87	TOC	1.16E+03
TOC	50366	12/18/87	TOC	1.09E+03

The following table lists the methods that are coded in the method column.

Code	Analytical Method	Reference
ABN	Semivolatile Organics (GC/MS)	USEPA-8270
AEA	^{241}Am	UST-20Am01
AEA	Curium Isotopes	UST-20Am/Cm01
AEA	Plutonium Isotopes	UST-20Pu01
AEA	Uranium Isotopes	UST-20U01

Table B-1. Data for 209-E Laboratory Reflector Water. (sheet 3 of 4)

Code	Analytical Method	Reference
ALPHA	Alpha Counting	EPA-680/4-75/1
ALPHA-Ra	Total Radium Alpha Counting	ASTM-D2460
BETA	Beta Counting	EPA-680/4-75/1
BETA	^{90}Sr	UST-20Sr02
COLIF	Coliform Bacteria	USEPA-9131
COLIFMF	Coliform Bacteria (Membrane Filter)	USEPA-9132
COND-Fld	Conductivity-Field	ASTM-D1125A
COND-Lab	Conductivity-Laboratory	ASTM-D1125A
CVAA	Mercury	USEPA-7470
CVAA/M	Mercury-Mixed Matrix	USEPA-7470
DIGC	Direct Aqueous Injection (GC)	UST-70DIGC
DIMS	Direct Aqueous Injection (GC/MS)	"USEPA-8240"
DSPEC	Reactive Cyanide (Distillation, Spectroscopy)	USEPA-CHAPTER 7
DTITRA	Reactive Sulfide (Distillation, Titration)	USEPA-CHAPTER 7
FLUOR	Uranium (Fluorometry)	ASTM-D2907-83
GEA	Gamma Energy Analysis Spectroscopy	ASTM-D3649-85
GFAA	Arsenic (AA, Furnace Technique)	USEPA-7060
GFAA	Lead (AA, Furnace Technique)	USEPA-7421
GFAA	Selenium (AA, Furnace Technique)	USEPA-7740
GFAA	Thallium (AA, Furnace Technique)	USEPA-7841
IC	Ion Chromatography	EPA-600/4-84-01
ICP	Atomic Emission Spectroscopy (ICP)	USEPA-6010
ICP/M	Atomic Emission Spectroscopy (ICP)-Mixed Matrix	USEPA-6010
IGNIT	Pensky-Martens Closed-Cup Ignitability	USEPA-1010
ISE	Fluoride-Low Detection Limit	ASTM-D1179-80-B
ISE	Ammonium Ion	ASTM-D1426-D
LALPHA	Alpha Activity-Low Detection Limit	EPA-680/4-75/1
LEPD	^{129}I	UST-20I02
LSC	^{14}C	UST-20C01
LSC	Tritium	UST-20H03
LTOX	Total Organic Halides-Low Detection Limit	USEPA-9020
PH-Fld	pH-Field	USEPA-9040
PH-Lab	pH-Laboratory	USEPA-9040
SPEC	Total and Amenable Cyanide (Spectroscopy)	USEPA-9010
SPEC	Hydrazine-Low Detection Limit (Spectroscopy)	ASTM-D1385
SSOLID	Suspended Solids	SM-208D
TC	Total Carbon	USEPA-9060
TDS	Total Dissolved Solids	SM-208B
TEMP-Fld	Temperature-Field	Local
TITRA	Alkalinity-Method B (Titration)	ASTM-D1067B
TITRA	Sulfides (Titration)	USEPA-9030
TOC	Total Organic Carbon	USEPA-9060
TOX	Total Organic Halides	USEPA-9020
VOA	Volatile Organics (GC/MS)	USEPA-8240

Table B-1. Data for 209-E Laboratory Reflector Water. (sheet 4 of 4)

Sample # is the number of the sample. See Section 3.0 for corresponding chain-of-custody number. Date is the sampling date. Results are in ppb (parts per billion) unless otherwise indicated.

Analytical Method Acronyms:
AA = atomic absorption spectroscopy.
GC = gas chromatography.
MS = mass spectrometry.
ICP = inductively-coupled plasma spectroscopy.

References:

ASTM--"1986 Annual Book of ASTM Standards," American Society for Testing and Materials, Philadelphia, Pennsylvania.

EPA--Various methods of the U.S. Environmental Protection Agency, Washington, D.C.

UST--Methods of the United States Testing Company, Incorporated, Richland, Washington.

SM--"Standard Methods for the Examination of Water and Wastewater," 16th ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.

USEPA--"Test Methods for Evaluating Solid Waste Physical/Chemical Methods," 3rd ed., SW-846, U.S. Environmental Protection Agency, Washington, D.C.

APPENDIX C

SUMMARY OF 200 EAST AREA RAW WATER AND SANITARY WATER DATA (1985-1988)

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Table C-1. Summary of 200 East Area Raw Water and Sanitary Water Data (1985-1988).

Constituent/Parameter [all ppb, exceptions noted]	Raw Water[2] (1986-1987)			Sanitary Water[1] (1985-1988)		
	N[3]	AVG	STD DEV	N	AVG	STD DEV
Arsenic				4	<5.00 E+00	NA
Barium	5	2.80 E+01	3.40 E+00	4	[4]1.05 E+02	1.00 E+01
Cadmium	5	2.40 E+00	8.94 E-01	4	<5.00 E-01	NA
Calcium	5	1.84 E+04	1.47 E+03			
Chromium				4	<1.00 E+01	NA
Chloride	5	8.71 E+02	2.37 E+02	4	3.00 E+03	6.76 E+02
Conductivity-field (µS)	5	9.32 E+01	4.61 E+01			
Copper	5	1.06 E+01	1.34 E+00	4	[4]2.50 E+01	1.00 E+01
Color (units)				4	<5.00 E+00	NA
Iron	5	6.36 E+01	2.57 E+01	4	<8.25 E+01	5.19 E+01
Fluoride				4	<1.13 E+02	2.50 E+01
Lead				4	<5.00 E+00	NA
Magnesium	5	4.19 E+03	4.83 E+02			
Manganese	5	9.80 E+00	3.49 E+00	4	<1.00 E+01	NA
Mercury				4	<5.00 E-01	NA
Nickel	5	1.04 E+01	8.94 E-01			
Nitrate	5	9.96 E+02	8.79 E+02	4	[4]3.72 E+02	5.44 E+02
pH (dimensionless)	5	7.41 E+00	1.18 E+00			
Potassium	5	7.95 E+02	6.24 E+01			
Selenium				4	<5.00 E+00	NA
Silver				4	<1.00 E+01	NA
Sodium	5	2.26 E+03	2.42 E+02	4	2.28 E+03	1.26 E+02
Sulfate	5	1.06 E+04	9.97 E+02	4	1.68 E+04	3.37 E+03
Temperature-field (C)	5	1.64 E+01	5.84 E+00			
TOC (µg/g)	5	1.36 E+03	2.53 E+02			
TDS (mg/L)				4	8.10 E+01	1.69 E+01
Trichloromethane	5	1.18 E+01	4.02 E+00			
Uranium	4	7.26 E-01	2.22 E-01			
Zinc	5	2.00 E+01	2.12 E+01	4	<1.00 E+02	NA
Radionuclides (pCi/L)						
Alpha Activity	4	8.85 E-01	5.30 E-01			
Beta Activity	4	4.47 E+00	1.76 E+00			

[1]Compiled from HEHF, "Hanford Sanitary Water Quality Surveillance, CY 1985," HEHF-55, Hanford Environmental Health Foundation, Environmental Health Sciences, April 1986, and HEHF-59, HEHF-71, and HEHF-74 (corresponding reports for calendar years 1986, 1987, and 1988).

[2]Compiled from Substance Toxicity Evaluation of Waste Data Base provided by F. M. Jungfleisch (this data is an update of the data presented in WHC-EP-0052, "Preliminary Evaluation of Hanford Liquid Discharges to Ground), published August 1988.

[3]N is defined as the number of test results available for a particular analyte. N may reflect both single and multiple data sets.

[4]Averages include a mix of above- and below-detection limit in computations when the actual values are below the detection limit.

ppb = parts per billion
µS = microsiemens
µg = micrograms
TOC = Total Organic Carbon
TOX = Total Organic Halides
TDS = Total Dissolved Solids
pCi/L = picocuries/liter.

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